REMARKS

Reconsideration of the rejections set forth in the Office action mailed October 4, 2003 is respectfully requested. Claims 1-19 are currently under examination.

I. Amendments

Claims 1 and 3 have been amended for clarity and to correct obvious errors. For example, claim 3 should not depend from claim 2, since it recites that "the first port is axially aligned with the second port", while claim 2 recites a different embodiment, where "the first port is axially disposed between the second and third ports". Claim 13 is amended for clarity to recite that the voltage controller operates to apply and control voltage as described. Support if found, for example, at page 7, lines 27-30 of the specification.

No new matter is added by any of the amendments.

II. Rejections under 35 U.S.C. §102(b)

Claims 1-9 and 13-17 were rejected under 35 U.S.C. §102(b) as being anticipated by Ramsey *et al.*, U.S. Patent No. 5,858,187. This rejection is respectfully traversed for the following reasons.

The standard for lack of novelty, that is, for anticipation, is one of strict identity. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F2d 1367, 231 USPQ 81, 90 (Fed. Cir. 1986); *In re Donohue*, 766 F2d 531, 226 USPQ 619, 621 (Fed. Cir. 1985). To anticipate a claim for a patent, a single prior source must contain all its essential elements.

A. The Invention

The applicant's invention, as embodied in independent claim 1, is directed to a method of injecting a liquid sample into an electrolyte channel in a microfluidics device. As recited in the claim, the device has a channel network that includes an electrolyte channel having upstream and downstream channel portions and first, second, and third side channels that intersect the electrolyte channel between the two channel portions at first, second, and third ports, respectively. At least one of the ports is axially spaced along the electrolyte channel from the other two ports. The method comprises the steps of:

(a) supplying a sample to the first side channel,

(b) applying across the first side channel and at least one of the other side channels, a voltage potential effective to move sample in the first channel into a volume element of the electrolyte channel, said volume element extending between the first port and at least one other port which is axially offset from the first port,

(c) simultaneously controlling the voltage applied to the three side channels, to create a sample volume element in the electrolyte channel having a desired leading- and trailing-edge shape and/or distribution of sample components, and

(d) simultaneously controlling the voltage applied to the upstream and downstream channel portion, and to at least two of the side channels, to advance this sample element in a downstream direction within the electrolyte channel.

<u>Independent claim 13</u> is directed to a microfluidic system designed for use in injecting a defined-volume liquid sample into an electrolyte channel, for transport through the channel. The system comprises:

a microfluidic device having a channel network that includes such an electrolyte channel having upstream and downstream channel portions and first, second, and third side channels that intersect the electrolyte channel between the two channel portions at first, second, and third ports, respectively, where at least one of the ports is axially spaced along the electrolyte channel from the other two ports,

ports for supplying liquid medium to the electrolyte channel and the side channels,

upstream and downstream electrodes, and first, second, and third electrodes adapted to communicate with liquid medium contained in upstream and downstream portions of the electrolyte channel, and the first, second, and third side channels, respectively, and

a voltage controller, which operates to:

(a) apply across the first side channel and at least one of the other two side channels, a voltage potential effective to move a liquid sample contained in the first channel into a volume element of the electrolyte chamber extending between the first and at least one other port which is axially offset from the first port,

(b) simultaneously control the voltage applied to the three side channels, and at least one of said upstream and downstream channel end portions, to create a sample volume element in the

electrolyte channel that has a desired leading- and trailing-edge shape and/or distribution of sample components within the volume elements, and

(c) simultaneously control the voltage applied to the upstream and downstream channel portion, and to at least two of the side channels, to advance the sample element having a desired leading- and trailing-edge shape and/or distribution of sample components in a downstream direction within the electrolyte channel.

B. The Prior Art

Ramsey *et al.* is directed to methods of capillary electrophoresis in which sample is transported from a sample reservoir to a "focusing chamber" (column 4, lines 10-12). At the focusing chamber, streams of buffer, electrodynamically transported from laterally placed "focusing reservoirs", are used to laterally focus or confine the sample (column 4, lines 15-16, 35-38; illustrated in Figs. 2 and 4). This process is illustrated, for example, in Figs. 2 and 4 of the patent.

The channel network employed in these methods, as illustrated in Figure 1, includes a "sample reservoir **12**, a sample waste reservoir **14**, a buffer reservior **16**, a waste reservoir **18**, and focusing reservoirs **20**, **22**" (column 1, lines 28-31). As described at column 2, lines 15-19 and 28-30: "The invention entails using the focusing reservoirs **20** and **22** to laterally focus the sample transported from sample reservoir **12** to waste reservoir **18**. The electric potentials at the sample reservoir **12**, and focusing reservoirs **20** and **22**, are controlled independently. No potential is applied to the buffer and sample waste reservoirs **16** and **14**; *i.e,* the reservoirs are electrically floated."

In view of this description, the reference does not show "simultaneously controlling the voltage applied to the three side channels" (element (c) of applicants' claims 1 and 13). As stated in Ramsey, "No potential is applied to the buffer and sample waste reservoirs **16** and **14**; i.e, the reservoirs are electrically floated." Therefore, the reference shows "simultaneously controlling the voltage" of, at most, only two side channels (i.e. those leading to focusing reservoirs **20** and **22**).

Since the reference does not disclose all of the elements set out above in independent claims 1 and 13 and their dependent claims, these claims cannot be anticipated by this reference under 35 U.S.C. §102(b). In view of this, the applicant respectfully requests the Examiner to withdraw

the rejection under 35 U.S.C. §102(b).

III. Rejections under 35 U.S.C. §103

Claims 10-12 and 18-19 were rejected under 35 U.S.C. §103 as being unpatentable over Ramsey et al., cited above, in view of Chow *et al.*, U.S. Patent No. 6,174,675. The rejections are respectfully traversed in light of the following remarks.

A. The Invention

The invention of independent claim 1 and of independent claim 13 is described above. Dependent claims 10-12 and 18-19 further provide that step (b) includes applying a DC voltage potential across the first and second side channels, and step (c) includes applying an AC voltage between the third side channel and an upstream or downstream channel portion. As shown in Fig. 7B and described in the paragraph bridging pages 17-18 of the specification, the alternating voltage field is effective to produce dielectric focusing of sample components at the upstream end of the sample volume.

B. The Cited Art

Ramsey *et al.* is described above.

Chow *et al.* describes the use of electrical current for controlling and/or monitoring fluid parameters, particularly temperature, in microchannels. As shown by the Summary of the Invention at columns 3-5, the various aspects of the invention are primarily concerned with the use of electric current within microchannels to control and/or monitor fluid temperature. For example, at column 3, lines 49-51: "The energy source provides a voltage across the fluid such that a portion of a fluid is heated in a portion of the capillary channel."

The use of alternating and direct current is discussed at column 17, lines 31-63 of the patent. The reference teaches that, while both can be used for heating (e.g. lines 34-36, 45), AC can be used "to heat the material...without adversely affecting the movement of that material" (lines 40-42, 48-50). This is reiterated in Example 2, directed to a thermal cycling reaction, which states that use of an AC power source prevented electroosmotic flow of material, while a DC power supply could be used to electroosmotically transport materials (and to heat the materials, as stated at lines 22-24).

C. Analysis

Since Chow describes the use of alternating current in a microfluidic device for the purpose of heating fluid material, without producing electroosmotic flow, there would be no motivation to apply the technique to the Ramsey system, which is concerned with controlled flow and separation of materials. The Ramsey reference does not provide any suggestion that one would wish to use electric current for heating in the systems described.

Moreover, the references, even if combined, do not suggest the claimed invention. As noted above, the applicants' independent claims include at least one element not taught by Ramsey or Chow; that is, the aspect of "simultaneously controlling the voltage applied to [the] three side channels" in the process of injecting a sample into a separation channel. The teachings of Chow regarding temperature control in microchannels do not make up for this deficiency.

In view of the foregoing, the applicant respectfully requests the Examiner to withdraw the rejection under 35 U.S.C. §103.

IV. Conclusion

In view of the foregoing, the applicant submits that the claims now pending are now in condition for allowance. A Notice of Allowance is, therefore, respectfully requested.

No further fees are believed due with this communication. However, the Commissioner is hereby authorized and requested to charge any deficiency in fees herein to Deposit Account No. 50-2207.

If in the opinion of the Examiner a further telephone conference would expedite the prosecution of the subject application, the Examiner is encouraged to call the undersigned at (650) 838-4403.

Respectfully submitted,

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Amendments to claims filed April 2, 2003
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1. (Amended) A method of injecting a liquid sample into an electrolyte channel in a microfluidics device having a channel network that includes an electrolyte channel having upstream and downstream channel portions and first, second, and third side channels that intersect the electrolyte channel between the two channel portions at first, second, and third ports, respectively, where at least one of the ports is axially spaced along the electrolyte channel from the other two ports, said method comprising

(a) supplying a sample to the first side channel,

(b) applying across the first side channel and at least one of the other two side channels, a voltage potential effective to move sample in the first channel into a volume element of the electrolyte [chamber] <u>channel</u> extending between the first <u>port</u> and at least one other port which is axially offset from the first port,

(c) simultaneously controlling the voltage applied to the three side channels, and optionally, at least one of said upstream and downstream channel end portions, to create a sample volume element in the electrolyte channel that has a desired leading- and trailing-edge shape and/or distribution of sample components within the volume element[s], and

(d) simultaneously controlling the voltage applied to the upstream and downstream channel portion, and to at least two of the side channels, to advance the sample element having a desired leading- and trailing-edge shape and/or distribution of sample components in a downstream direction within the electrolyte channel.

3. (Amended) The method of claim [2] <u>1</u>, wherein the first port is axially aligned with the second port.

13. (Amended) A microfluidic system designed for use in injecting a defined-volume liquid sample into an electrolyte channel, for transport through the channel, comprising

a microfluidic device having a channel network that includes such an electrolyte channel having upstream and downstream channel portions and first, second, and third side channels that intersect the electrolyte channel between the two channel portions at first, second, and third

ports, respectively, where at least one of the ports is axially spaced along the electrolyte channel from the other two ports,

ports for supplying liquid medium to the electrolyte channel and the side channels,

upstream and downstream electrodes, and first, second, and third electrodes adapted to communicate with liquid medium contained in upstream and downstream portions of the electrolyte channel, and the first, second, and third side channels, respectively, and

a voltage controller operatively connected to the upstream downstream, and first, second, and third electrodes, [for] which operates to

(a) apply[ing] across the first side channel and at least one of the other two side channels, a voltage potential effective to move a liquid sample contained in the first channel into a volume element of the electrolyte chamber extending between the first and at least one other port which is axially offset from the first port,

(b) simultaneously control[ling] the voltage applied to the three side channels, and at least one of said upstream and downstream channel end portions, to create a sample volume element in the electrolyte channel that has a desired leading- and trailing-edge shape and/or distribution of sample components within the volume elements, and

(c) simultaneously control[ling] the voltage applied to the upstream and downstream channel portion, and to at least two of the side channels, to advance the sample element having a desired leading- and trailing-edge shape and/or distribution of sample components in a downstream direction within the electrolyte channel.